Homework 05 solution
STAT 509 Statistics for Engineers
Summer 2017 Section 001
Instructor: Tahmidul Islam

Question 01

Airplanes approaching the runway for landing are required to stay within the localizer (a certain distance left and right of the runway). When an airplane deviates from the localizer, it is sometimes referred to as an exceedence. Consider one airline at a small airport with six daily arrivals and an exceedence rate of 7%.

a Point out the "trial", "success" and "p".

b Find the probability that on one day no planes have an exceedence. Calculate it by hand.

c Find the probability that at least 1 plane exceeds the localizer. Calculate it by hand.

d Using R to calculate the probability in (b) and (c).

e What is the expected number of planes to exceed the localizer on any given day?

f What is the standard deviation for the number of planes to exceed the localizer on any given day?

Solution:

(a) Trial = Each landing. Success = Having exceedence. p = 0.07.

(b) Let, X = Number of planes having exceedence. So, $X \sim Bin(n = 6, p = 0.07)$.

$$P(X = 0) = \binom{n}{x} p^x (1-p)^{n-x}$$
$$= \binom{6}{0} p^0 (1-p)6 = 0.93^6 = 0.6469902.$$

(c)

$$P(X \geq 1) = 1 - P(X = 0) = 0.3530098$$

(d)

```
#P(X=0)
dbinom(0,size = 6,prob = .07)
#P(X >= 1)
1 - pbinom(0,size = 6,prob = .07)
#Equivalently
1 - dbinom(0,size = 6,prob = .07)
```

(e) $E(X) = np = 6 \times .07 = 0.42$.

(e) $Var(X) = np(1-p) = 0.3906$.
$SD(X) = \sqrt{Var(X)} = 0.62498$.